



**(43) International Publication Date**  
**6 June 2002 (06.06.2002)**

**PCT**

**(10) International Publication Number**  
**WO 2002/043980 A3**

**(51) International Patent Classification<sup>7</sup>: B60K 6/12, B60T 1/10, F16D 61/00, F15B 1/02, 21/14**

Gansey Mill, Beach Road, Port St. Mary, Isle of Man IM9 5NE (GB). **MATTIN, Peter, Russell** [GB/GB]; Inchanga, Pinfold Hill, Laxey, Isle of Man IM4 7HN (GB).

**(21) International Application Number:**  
PCT/IB2001/002785

(74) Agents: NEWSTEAD, Michael, J. et al.; Page Hargrave, Southgate, Whitefriars, Lewins Mead, Bristol BS1 2NT (GB).

**(22) International Filing Date:**  
28 November 2001 (28.11.2001)

(81) **Designated States (national):** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GR, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(25) Filing Language: English

(26) Publication Language: English

<b>(30) Priority Data:</b>		
PR 1705	28 November 2000 (28.11.2000)	AU
PR 4493	20 April 2001 (20.04.2001)	AU

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**(71) Applicant (for all designated States except US): SHEP LIMITED [GB/GB]; 24 Finch Road, Douglas, Isle of Man IM1 2PS (GB).**

(72) Inventors; and

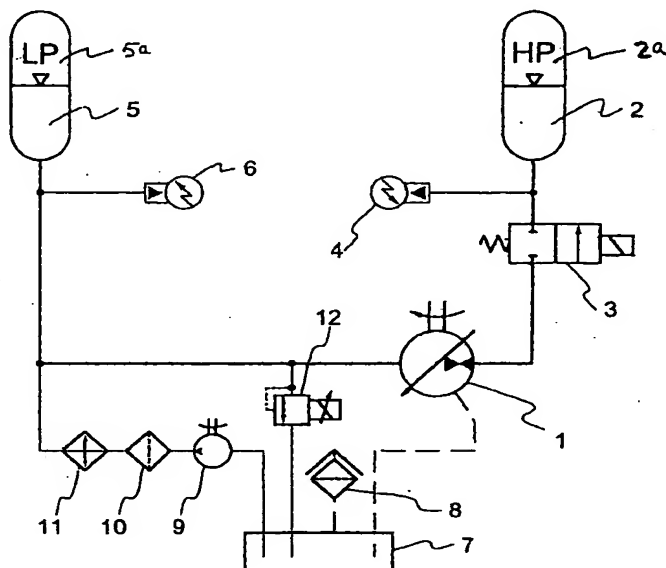
(75) **Inventors/Applicants (for US only):** **FRAZER, Hugh, Ivo** [AU/AU]; Cliftonville Road, Lower Portland, NSW 2756 (AU). **EVANS, William, Raymond** [GB/GB]; 2

**Published:**

— with international search report

*[Continued on next page]*

(54) Title: HYDRAULIC ENERGY STORAGE SYSTEMS



(57) Abstract: A hydraulic energy storage system for vehicles to provide higher efficiency, smaller package size, lower weight, unitary construction, durability and enhanced reliability while maintaining the capability to efficiently store and restore energy at high power levels.



(88) Date of publication of the international search report:  
13 May 2004

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

PCT/IB 01/02785

A. CLASSIFICATION OF SUBJECT MATTER		
IPC 7	B60K6/12	B60T1/10 F16D61/00 F15B1/02 F15B21/14
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC 7 B60K B60T F15B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 42 12 542 A (HUBER KURT) 21 October 1993 (1993-10-21) the whole document	1,2, 11-14
A	US 2 721 446 A (BUMB RICHARD C) 25 October 1955 (1955-10-25) cited in the application the whole document	1,2,11
A	US 5 579 640 A (GRAY JR CHARLES L ET AL) 3 December 1996 (1996-12-03) the whole document	1,2
-/--		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "Z" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
9 September 2002		03.02.03
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl Fax: (+31-70) 340-3016		Authorized officer  Vogt-Schilb, G

## INTERNATIONAL SEARCH REPORT

PCT/IB 01/02785

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>PATENT ABSTRACTS OF JAPAN vol. 1995, no. 05, 30 June 1995 (1995-06-30) &amp; JP 07 032992 A (MITSUBISHI MOTORS CORP), 3 February 1995 (1995-02-03) abstract -----</p>	1,2

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

PCT/IB 01/02785

## Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1, 2, 11-14

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.  
☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

1. Claims: 1,2,11-14

Hydraulic energy storage system with high pressure accumulator, a pump/motor and two low pressure accumulators. The claim 11 drafted as compensated accumulator is also seen as a system.

2. Claims: 3,15-24

Compensated accumulator with coaxial high and low pressure chambers having pistons connected by at least three rods

3. Claims: 4-7

Compensated accumulator with coaxial high and low pressure chambers having piston position sensors

4. Claims: 8-10,25

Compensated accumulator with coaxial high and low pressure chambers having connected pistons and integrally formed with a valve block

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 01/02785

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4212542 A	21-10-1993	NONE	
US 2721446 A	25-10-1955	NONE	
US 5579640 A	03-12-1996	AU 5636696 A CA 2219147 A EP 0826112 A WO 9634213 A	18-11-1996 31-10-1996 04-03-1998 31-10-1996
JP 07032992 A	03-02-1995	NONE	

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☒ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**